August - September 1972

EMO

Committee Report

Misconceptions about Radiation

Municipal Preparedness

Radio Warning in the U.S.

China's Nuclear Deterrent

CANADA EMERGENCY MEASURES ORGANIZATION

EMO
NATIONAL DIGEST

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In addition to publishing articles which reflect Canadian Government policy the Digest may also publish articles by private individuals on subjects of current interest to the emergency measures programme. The views of these contributors are not necessarily subscribed to by the Federal Government.

Editor: A. M. Stirton

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HOUSE OF COMMONS COMMITTEE REPORT

On June 29, 1972 the Chairman of the Standing Committee on External Affairs and Defence, the Honorable Ian Wahn presented the Committee's third report to Parliament. The following excerpts are taken from Votes and Proceedings of the House of Commons, Number 84.

Persuant to its Order of Reference of Thursday, February 24, 1972, your Committee has considered the White Paper entitled "Defence in the 70s" and has agreed to report as follows:

PREFACE

Terms of reference and scope of hearings

On February 24, 1972, the White Paper entitled "Defence in the 70s" was referred by the House of Commons to the Standing Committee on External Affairs and National Defence. Since the Committee had earlier in the 28th Parliament reported on Canadian defence policy with respect to NATO, NORAD, the United Nations and Peacekeeping, and Maritime Forces, it decided to concentrate most of its effort on reviewing the use of Canadian Armed Forces for the Protection of Canada, including particularly national support and development, assistance to civil authorities and the maintenance of internal security. In concentrating on these aspects, the Committee reserved for further consideration a basic review of the overall defence priorities as detailed on page 16 in the White Paper.

Written briefs

Advertisements were placed in newspapers across the country inviting written submissions. Major interest groups and associations with an interest in defence policy were invited by letter to submit written briefs. Written briefs were submitted by individuals from all parts of Canada and from a diverse range of interest groups and associations...

Oral hearings

The Committee invited the Minister of National Defence, the Honourable E. J. Benson, to elaborate on the White Paper in general terms. Senior officials from the Department of National Defence were subsequently asked to give evidence on the use of Canadian Armed Forces for national support and development, for assistance to civil authorities, and for the maintenance of internal security, as well as a briefing on the role and status of Reserve Forces. These meetings provided the Committee with valuable background information.

Some of the written briefs submitted contained statements and opinions that needed elaboration. Accordingly, one individual and representatives of seven organizations were invited to appear before the Committee to provide supplementary oral evidence. To provide the Committee with a different perspective from that of officials from the Department of National Defence, the Committee also invited Dr. Denis Szabo to comment on psychological and sociological implications of the use of Canadian Armed Forces for internal security, and Mr. Ian Smart of the International Institute for Strategic Studies, to comment more generally on the implications of the non-military use of armed forces . . .

INTRODUCTION

The Committee agrees with the basic assumption in the White Paper on Defence that the Canadian Armed Forces can be used with advantage for purposes of a basically non-military nature within Canada, including many of the specific purposes cited in the White Paper. However, the Committee believes it is desirable that the roles of the Canadian Forces should be more clearly defined in these contexts, certain ambiguities clarified, some potentially contentious issues settled and guidelines for the use of Canadian Armed Forces clearly and visably set down, in order to avoid possible adverse effects and unanticipated costs that might more than outweigh the immediate benefits sought. While recognizing that the White Paper is a statement of general intent and policy, the Committee believes that a careful examination of the overall implications of such non-military tasks is important.

The Committee's comments and recommendations on these various points comprise the main substance of this interim report. In addition some comments on various other points relating to defence policy not previously dealt with by this Committee in earlier reports are also included.

USE OF CANADIAN ARMED FORCES FOR NATIONAL SUPPORT AND DEVELOPMENT PURPOSES

The White Paper on Defence notes that:

> "Although maintained primarily for purposes of sovereignty and security, the Department of National Defence provides an important reservoir of skills and capabilities which in the past has been drawn upon, and which in the future can be increasingly drawn upon, to contribute to the social and economic development of Canada." (p. 12)

In this context, under the general title of national development, a broad range of activities of a non-military nature, unrelated to the four primary defence priorities, are designated.

The Committee examined the justification given for using the facilities and resources of the Department of National Defence for these activities rather than those of other agencies of the federal government, agencies of provincial governments or those in the private sector. The main reason given in the White Paper for using the Armed Forces is that:

> "The inherent characteristics of the Armed Forces combine effective command and organization, high mobility, and a range of skills and specialities broader than that of any other national organization. These provide Canada with a resource which may be used to carry out essentially non-military projects of high priority and importance to national development. The objective will be to use the Forces primarily on projects which relate to theis capabilities to respond efficiently and promptly to their basic defence croles."

It adds that "The Forces will be called upon, therefore, in conjunction with other government departments to assist development in the civil sector, especially in the remote regions where disciplined task forces with wide experience in adapting to unusual or challenging circumstances is required." A secondary reason is also alluded to in the statement that:

> "A further objective of this policy will be to promote greater involvement of the military in the community and to ensure that the community is aware of the ways in which the military sector contributes to achieving national aims and priorities."

Availability of Canadian Armed Forces for provision of assistance in emergencies and search and rescue

The White Paper notes that "The Forces and the Canada Emergency Measures Organization will continue to play an important part in providing relief and assistance in event of natural disasters or other civil emergencies including those resulting from oil spills or other forms of pollution." It further comments that the Forces have been used in the past to assist in flood control operations, fighting forest fires and has had major responsibilities for air-sea search and rescue activities. In subsequent evidence given by departmental officials it was stated that current responsibilities for emergency and disaster relief and search and rescue would not only be continued, but would be given first priority amongst the various national support and development tasks.

The Committee agrees wholeheartedly with the use of Canadian Armed Forces in this emergency role. The established command and control system, communications network, transportation facilitie, and equipment and the wide variety of trained personnel are obviously relevant. Such activities being by nature unexpected and challenging and likely to occur in any part of Canada also provide realistic training for other primary defence activities. . . .

A special case in the provision of assistance in emergencies is that of assigning to the Canadian Armed Forces specific responsibility for co-ordinating search and rescue operations and in providing equipment for these in conjunction with that provided by other agencies. While this is a heavy responsibility in terms of equipment and manpower, which has to be kept on standby, it is an obvious requirement on humanitarian grounds and also a commitment of Canada as a member of the International Civil Aviation Organization.

The Committee believes, however, that some clarification is needed as to the allocation of costs for emergency relief operations of all kinds and for search and rescue. It considers that both these areas of activity are primarily services provided by the Canadian Armed Forces on the basis of their obvious expertise rather than an inherent part of the defence program. Since these are service functions that must be provided quite independently of defence requirements per se, the Committee believes that costs involved should not be included in the regular defence budget. In particular, the Committee feels that the availability of funds for new search and rescue equipment should not be judged in the context of the capital procurement needs of the Canadian Armed Forces for defence activities.

In these cases the Committee considers that the funds necessary to cover the full costs of domestic emergency relief, other than search and rescue, should be provided through an allocation to the Canadian Emergency Measures Organization. The personnel and equipment of the Canadian Armed Forces kept permanently available for the core service in this area should likewise be charged to the EMO budget. If additional facilities of the Canadian Armed Forces or the Reserve Forces are used, the cost incurred should be recovered from the EMO budget so as not to reduce other areas of the defence budget which have been established for other purposes. In making this recommendation, the Committee accepts that orientation of the EMO program would have to be broadened.

In the case of search and rescue, the Committee recommends that costs be allocated either to EMO or to the Ministry of Transport. In the case of international emergency relief assistance costs should be allocated to the Department of External Affairs budget.

In each case the allocation of the costs to these budgets should not just be a book-keeping entry. Information received by the Committee indicates that such non-defence activities have effectively used up part of the resources available for defence purposes. To rectify this the Committee believes that the Department of National Defence should be allowed to recover equivalent funds to be used for defence purposes. . . .

Clarification of priorities within national development activities

The White Paper on Defence gives no indication as to the relative priority of the various types of national development activities cited. Given the limited resources available to the Canadian Armed Forces the Committee considers that such a set of priorities should be made known to the public. Subsequent to publication of the White Paper, the Committee has received evidence from the Department outlining these priorities as follows:

> "On the basis of the need for the Canadian Forces to participate in a meaningful and beneficial national support and development program, the following activities suggest themselves in order of priority: *Emergency and disaster relief and search and rescue:* Current responsibilities should be continued. . . .
>
> *Antipollution and conservation:* The Department can make a considerable contribution when called upon; thus, antipollution measures within the Department should be continued and plans for emergencies co-ordinated with other departments and agencies. . . .

THE NUCLEAR THREAT AND CIVIL DEFENCE

The White Paper states "A catastrophic war between the super powers constitutes the only major military threat to Canada. It is highly unlikely Canada would be attacked by a foreign power other than as a result of the strategic nuclear strike directed at the U.S. Our involvement would be largely a consequence of geography; Canada would not be singled out for separate attack. There is, unfortunately, not much Canada herself can do by way of effective direct defence that is of relevance against massive nuclear attack, given the present state of weapons technology, and the economic restraints on a middle power such as Canada.

Canada's overriding defence objective must therefore be the prevention of nuclear war by promoting political reconciliation to ease the underlying causes of tension, by working for arms control and disarmament agreements and by contributing to the system of stable mutual deterrents."

Evidence presented to the Committee indicates that properly devised civil defence measures can be effective in reducing civilian casualties in the event of nuclear attack. Articles published in recent years by the Emergency Measures Organization have questioned the assumption that even massive nuclear attacks will necessarily result in complete destruction and have emphasized that proper measures of civil defence can be extremely effective in reducing casualties and preserving property both during the attack and in the post-attack period when law and order might break down completely in the absence of such measures.

There is no discussion whatsoever of civil defence in the 1971 White Paper. The previous White Paper published in March, 1964 did refer to this subject and included the following statement:

> "As has been indicated, the future priority to be assigned to civil defence measures will be influenced greatly by the decision to deploy or not to deploy an anti-ICBM system. Until this major decision has been taken, it is not possible to resolve a large number of lesser policy matters in the civil defence field. In the meantime, approved projects will be completed and maintained."

Since decisions with regard to the anti-ICBM system have now been made and in view of the importance of the subject as indicated above, the Committee urges that the Government undertake a complete review of the relevance and importance of civil defence in relation to its defence policy, the priority which should be accorded to it, the responsibility for it and the funds to be devoted to it.

The Committee agrees that Canada's overriding defence objective must be the prevention of nuclear war and with the emphasis placed by the White Paper upon promoting political reconciliation to ease underlying causes of tension and working for arms control and disarmament agreements. However, bearing in mind Canada's very limited defence budget in relation to the nuclear budgets of the United States of America, the Soviet Union and other nuclear powers, it does not consider that Canada can usefully make any very substantial financial contribution to the system of stable mutual nuclear deterrence except to the extent that this results indirectly from the performance of other roles. In fact, the Committee was reassured by the assertion of the Minister of National Defence that the reference in the White Paper to contributing to the system of stable mutual deterrence was meant to refer to Canada's existing warning system and anti-bomber and anti-submarine forces rather than to any new contributions to the system of stable mutual deterrence.▲

MISCONCEPTIONS ABOUT RADIATION

by

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Although there is common agreement that any exposure to nuclear radiation (other than for therapeutic reasons) is harmful to individuals, it is necessary to retain a proper perspective as to the capabilities and limitations of radiation effects. An understanding of the radiation problem enables many simple and practical steps to be taken to minimize exposures. This has been illustrated and is common practice in industry both in nuclear power plants and where radioactive isotopes are widely used. This paper will attempt to point out some facts about radiation and current misconceptions that are commonly held.

When a nuclear detonation occurs neutrons are released in the fission and fusion process which can make otherwise stable isotopes radioactive. Only neutrons which are emitted during this period of less than a second will cause other materials to become radioactive, and only within a limited range—a few hundred meters from ground zero.

Only after surface, subsurface or low airbursts will there be a significant operational problem from radioactive fallout. A surface burst is defined as a burst which when its fireball reacdes maximum size will touch the surface of the ground or water. This causes a joining together of radioactive particles in the cloud with materials from the surface. These are drawn up into the cloud and will result in radioactive fallout in the vicinity and downwind of the point of burst. These contaminating particles (fallout) do not make surfaces on which they fall "radioactive". They merely result in deposition of radioactive materials on the surface. If this deposition is removed, the surfaces involved are then clean and cause no hazard to those in the vicinity or those handling the materials concerned. Thus if an individual is exposed to gamma radiation or beta or alpha contamination he does not become radioactive. He does not become hazardous to anyone near him.

Although beta and alpha emitting substances may be inhaled or ingested, the hazard is relatively insignificant for operational consideration. Only on a very long term basis would the individual be likely to have a health problem because of a tendency for certain radioactive isotopes to become lodged in specific parts of the body. For operational situations the amount of contaminated material that he would have to inhale or ingest would be such that he would be dead from the amount of dirt or debris inside his body—not from the effects of radiation.

There has been a common misconception as to the effects of nuclear bomb testing on the ecology, particularly in relation to the deposition of strontium 90. There have been many articles written on the ingestion of strontium 90 by cows and the resultant effect on milk. A paper by Dr. Scott Russell, an eminent international authority on radiation, estimates that 1000 megatons of fission would give rise to about 200 picocuries of strontium per gram of calcium in milk for about 2 years. Since hydrogen or thermonuclear bombs are assumed to be about 50% fission and 50% fusion, 1000 megatons of fission would be the equivalent of $\frac{1000 \times 2..400}{5}$ five megaton H bombs. A picocurie is one million millionth of a curie or $\frac{1}{1{,}000{,}000{,}000{,}000}$. There are about 1.2 grams of calcium per liter of milk. Thus, Dr. Russell estimates that a radiation dose to the bone marrow of 0.04 rads per year would be produced.

In terms of risk this would be about 1/2400 of the risk from cigarette smoking or about 1/1000 the risk from automobile travel. The amount of Sr90 likely to be found in milk from nuclear testing is likely to produce additional body dose of radiation similar to moving your place of residence to an altitude 600 ft. higher than at present. Also, if you live in a concrete or brick building the amount of extra radiation dose received by the lungs is likely to be about 200 times the risk of drinking milk after nuclear tests.

The risk of radiation to unborn descendants is frequently of concern to the layman. It is accepted that without any man-made radiation there are an appreciable number of mutations, chromosomal aberrations and genetic deaths in every million conceptions. There is no evidence that the heatlh of mortality of mankind has been degraded over the centuries. Nature would appear to guard against the degradation of the species. For example about 15% of all pregnancies lasting long enough to be recognized, end in early abortion. A further significant proportion of conceptions terminate so early that abortion is unrecognized. The majority of aborted foetuses are grossly malformed or have other abnormalities. Nutritional damage results utlimately in genetic death and elimination of the inferior mutant strain.

Recent novels, for purposes of sensationalism or for fictional excitement, have tended to greatly exaggerate the effects of radiation after nuclear explosions. For example, a recent novel states "it would be another fifty years before a greater part of the prairies will be able to

produce crops that are reasonably free from radioactive poisoning". This was as a result, in the novel, of two, 50 megaton weapons inadvertently delivered by the USSR, one over the city of Edmonton and one between the cities of North Battleford and Saskatoon. This estimate has of course no basis in theoretical calculation or fact. In another chapter it refers to people who had presumably been exposed to the effects of immediate radiation and to quote "Many of them had stopped to lie down in the ditches. Later we discovered that these were the dead and dying who had sought relief from their radiation burns by lying down in the water in the bottom of ditches". Immediate radiation does not of course cause instantaneous burns of this type. Only beta emitters from heavy fallout may, if the exposed area of the body is not cleansed result in beta burns similar in some respects to thermal burns.

There are many similar examples of misconceptions concerning radiation effects in the book including: exaggerated distances to which dangerous fallout would extend, unrealistic times for onset of radiation symptoms and sickness, and unrealistic heights of burst to produce the fallout conditions described.

One additional fictional description may be worth quoting. "When I later flew over what had been the city of Saskatoon I found myself wondering at the profusion of flowers that covered the ruins. For miles around, the scorched earth had burst into the lush green growth of vegetation. Exposed to enormous doses of radiation, the normal cycle of plant life had been accelerated and telescoped into hours and days. It was springtime again in the last week of September." Although there is some experimentation to indicate that in certain cases radiation may cause stimulation in growth and crop yield, R. Scott Russell in his "Radioactivity and Human Diet" summarizes the situation as follows: "Apart from the now well established deleterious effects of radiation on plants, there are reports, recently reviewed by Sax (1963) that growth and crop yield may be stimulated by the exposure of seeds or growing plants to *low* doses of radiation. There is little consistency between the results of various investigations; in some instances growth was stimulated and in others it was depressed at similar exposures, while in many cases there were no discernable effects. Such a variable response is not surprising since the injury or incision of buds or other tissues may, depending on circumstances, either reduce or enhance the yield of crops. Indeed the stimulation of growth to which treatment with radiation sometimes leads might perhaps be compared to the effects of pruning in horticultural practice. Moreover as the process of auxin synthesis is particularly radiosensitive, the growth of tissues with a relatively high auxin requirement may be suppressed, while that of other tissues such as lateral buds may be stimulated."

Another recent novel concerning an accident to a nuclear power plant as a result of a severe earthquake also contain a number of misconceptions concerning radiation. One is led to believe that damage to the container holding fissionable materials would cause widespread radioactive fallout and the death of thousands of people in areas close to the plant and downwind from it, although no explosion took place and the material is merely exposed to the open air. In one situation, one of the engineers was exposed for five or six seconds to the emanations from the fissionable material and was stated to have received a massive radiation dose of over 10,000 rads of radiation. By calculation, this would mean that the intensity of the radiation would have to be 8,400,000 rads per hour which is completely unrealistic. A dose rate of that intensity would require an enormous thickness of lead for shielding purposes. In any event the fissionable material used in nuclear reactors would not have intensities of anywhere near that magnitude.

A further false statement was to the effect that after the populace had been exposed to radiation, it was necessary to test them with dosimeters to find out the amount of radiation exposure they had received. Obviously the only value of dosimeters is when they are worn during the exposure period so thay can record the dosage as received. They are of no value afterwards since the body does not in fact become radioactive. Only with whole body counters, used in medicine under specialized conditions is it possible to determine the extent and type of radioactive material that has been ingested, inhaled or deliberately placed in the body for therapeutic purposes. This would have no application under mass caualty conditions or when considering radiation doses received externally.

In summary while nuclear radiation in the absence of effective and carefully controlled safety and protective measures may result in a serious health hazard, it is not as devastating as fiction would lead one to believe. It is a common and understandable practice in fiction to sieze on a subject little understood by the layman and sensationalize it in the interests of narrative suspense and drama. The potential hazards from nuclear radiation demand and receive serious attention and have resulted in highly specialized and detailed control measures. Like any other form of energy, an understanding of its capabilities and limitations will enable nuclear radiation to be considered in proper perspective.▲

MUNICIPAL PREPAREDNESS

Mayor Edwin W. Wade of Long Beach, California, is a chief executive who is knowledgeable and concerned about emergency preparedness in his city. His address on this subject before a group of Mayors and Chamber of Commerce representatives of Japan is reprinted below. The occasion was the Second Plenary Session of the Japanese-American Conference of Mayors and Chamber of Commerce Representatives at Kyoto, Japan.

It is a high privilege for me to have this opportunity to address this conference on the subject of Anti-Disaster Measures In Cities. The earthquake which occurred in Los Angeles County on February 9th, 1971 has been another reminder, especially for those of us living in that immediate area, that it is indeed appropriate for us to focus some of our attention on the subject of disaster preparedness.

The City of Long Beach, which I represent, has made a concentrated effort during the past decade to develop an emergency preparedness program. I am satisfied that what we have accomplished will be of great benefit in a serious emergency, but the more I researched this subject in preparation for making this presentation today, the more I have become aware that much of the capacity inherent within our cities to deal with disasters lies dormant. I realize that even in the City of Long Beach much remains to be done before we can say that we have developed maximum readiness to help ourselves in time of disaster.

This matter of self-help is crucial to the development of a sound nationwide emergency preparedness program because if a city is not willing to develop a capability of sustaining itself in a disaster situation then it must prematurely call for help from the outside. This process of determining when, how, and from whom to request help uses up time and time is a precious commodity when citizens are in peril. Many lives can be lost in the confusion and disorganization that accompanies the lack of a full planning effort.

A city that fails to make a reasonable effort to develop its own capacity for survival thus allows itself to become a burden upon the higher echelons of government which must come to the rescue and too often the rescue becomes a salvage type operation.

As I see it, every community has a choice to make which simply stated, is whether in time of emergency it chooses to be an asset to itself and its nation or whether it is willing to be a liability. I seriously doubt if there are many, if any, cities in either of our two great countries that can honestly say that they have fully developed their potential for the protection of life and property. I'm talking about the full utilization of resources that stand available within our communities but which lie dormant simply awaiting the type of organization and planning that will take full advantage of the existing potential.

Sustaining a high degree of readiness, of course, is not easy. There are expenses involved, but in Long Beach we have found that the cost need not be burdensome. Our full time emergency preparedness staff is quite small. We take advantage of the incentives offered by the Federal Government to communities willing to achieve the eligibility standards imposed as a condition for receiving such assistance. The staff in Long Beach is a coordinating group working in a staff capacity for the City Manager with the mission of developing a maximum coordinated disaster readiness effort within the total structure of city government with such augmentation as needed from the private sector.

Recognizing that there are limits to what a city can do to help itself, Long Beach is a part of a master mutual aid plan which pledges its help to sister communities when, because of the size of the catastrophe, they have a need for outside help. They, in turn, are pledged to help us if and when we, too, require such assistance.

Maintaining a high degree of disaster readiness, however, is largely a question of attitude and the building of a proper attitude throughout the city governmental structure begins at the top where policy is established. It isn't enough for the legislative body of the community, in our case the City Council, to only pass an ordinance establishing an emergency preparedness program. The City Council must show an interest in the ongoing activities as well. It should require a good disaster plan to be submitted for its approval. It should insist that the plan is not only kept up to date, but fully utilizes the available resources as well. The Council should also make it possible for city personnel to receive a reasonable amount of training in carrying out their disaster assignments and insist that such training be realistic and of a team-building character. Disaster exercises should be held periodically. In our case, we hold two drills a year at which time the top executives of our city family become personally involved in the critical decision making process at our Emergency Operating Center—all based, of course, on simulated disaster situations.

It is at the Emergency Operating Center that we have a communication room with complete coverage of all radio nets and wire services within our city. It is here that we also have radio contact with the higher and adjacent echelons of government. Our training sessions are designed to develop the staff's ability to take full advantage of the communications available in order to quickly assess the developing disaster situation. The decision making process obviously can be no better than the information upon which it is based; and, of course, once a decision is made it must be communicated to the forces in the field that will carry it out.

In my judgment, it is essential to have a central place such as a well-protected emergency operating center where timely decisions based on accurate information can be well coordinated and then disseminated It is here at the Emergency Operating Center where actions are taken to ascertain what resources are available, where key officials with these various resources at their immediate command can put their heads together and make the extraordinary judgments required to overcome the extraordinary problems which make a disaster a disaster.

I do not think I can put too much stress on the need for good communications because without it you cannot even get started. In Long Beach, we tie our key hospitals into our radio system. We also work closely with our extensive group of amateur radio operators and with certain critical industries. But no communications system is complete unless it also provides a means to broadcast important information and instructions to the public. If the public is to be expected to cooperate and be helpful to themselves and to their government, it must be given official guidance and this guidance logically should come from the Emergency Operation Center, that one point in the community that has the "big picture" and can best meet the public's need and right to be informed. In Long Beach, we call this system EBS which stands for the Emergency Broadcasting System. With EBS, false rumors will hopefully be controlled and the public morale sustained.

Although I consider it essential to have an educational program for citizens, my research shows that in an open society it is most difficult to get large numbers of people to voluntarily attend training sessions related to disaster preparedness. This does not mean that the average citizen is disinterested in protective measures for himself and his family. The fact that nearly every citizen of the United States carries several types of insurance attests to a general concern for emergency protection. Every inquiry I have made has brought the same reply which in effect says that people favor emergency planning, but it is difficult for people to accept the fact that they may someday become personally involved in some kind of calamity. It is easy to put off preparing for something that may never happen. Nevertheless, educational progress is gradually being made. Every year, several thousand more people in Long Beach are exposed either in the form of scheduled courses or in a general indoctrination received when they visit our Emergency Operating Center for a conducted tour. On the average of two or three groups a week make appointments to see our EOC, as it is commonly called. One day it might be a Boy Scout Troop and the day following an organization of professional people. In every instance, they are pleased to know that the city has a positive approach to disaster preparedness.

Probably of greatest importance is the fact that more and more exposure is occurring within our school system. Disaster drills over and above fire drills have been required in our public schools for a number of years. Several years ago, two such drills a year also became mandatory for hospitals as part of the process of retaining accreditation. On February 26 of this year, we conducted our first major city-wide medical exercise involving the city's publicly owned hospitals. We hope to conduct these exercises annually from now on and also include the privately owned hospitals in the future.

We accept the fact that good training offers the greatest return for the time and energy invested; and for that reason, merits the greatest staff effort.

You might be interested in our plans for providing shelter for people rendered homeless due to disaster. Of course, we count heavily on the Red Cross to furnish the leadership and much of the staffing, but we do not feel that it is proper to just dump the whole load in their laps. Our planning is worked out jointly as a team effort. We augment the Red Cross staff by making available the city's entire roster of recreational employees and librarians. This makes a total staff of over 1,000 trained personnel immediateiy available to man sufficient predesignated elementary schools and recreational centers to house 10,000 disaster victims. All of the assigned facilities have cafeterias, toilets, and sleeping space to house the homeless in reasonable comfort. If necessary, the city's entire system of school facilities can be made available and with additional staffing provided by the various school faculties, it would be possible to house at least 100,000 more people. It is doubtful, however, if anything short of a war emergency would impose such a large requirement for sheltering the homeless.

The need to shelter a large mass of people, of course, would mean that a sizable area of the city has been devastated. Under these conditions, our city ordinance provides for either the City Manager, in his capacity as Director of Emergency Services, or the City Council to proclaim the existence of a disaster. Such a declaration automatically bestows upon the Director of Emergency Services extraordinary power sufficient to enable him to deal with the situation. In this status, he can legally issue proclamations establishing curfews, and/or setting forth rules and regulations as necessary to meet the city's needs. As Director, he activates and takes charge of the Emergency Operating Center, and the entire disaster organization is at his disposal. If necessary, he can close down private or public businesses or activities. He can also requisition and obligate the city for such supplies, equipment, and personal services as he deems necessary. All of this can be done without referral to the City Council. However, the Council is privileged to formally convene in order to ratify or negate an action or to delegate further authority if deemed appropriate. By proclaiming a disaster, it also becomes possible to immediately impose any additional building, traffic, or safety regulations that the situation dictates. For example, damaged buildings, if unsafe for occupancy, could be condemned, and if necessary, even destroyed and removed.

Starting with the Great Alaskan earthquake of March 27, 1964 up through the devastating hurricane known as Camille, we have witnessed in the United States

a series of legislative acts which have greatly expanded the Federal role in major disasters. The latest such legislation known as the Disaster Relief Act of 1970 considerably increases the scope of federal assistance especially to meet the needs of individual victims. This has been a considerable change from the policy that existed several years ago when the losses suffered by an individual were largely his own to endure. Although the Red Cross has always made every effort to meet the immediate needs of individuals, for the first time government has concerned itself with personal problems to include the long term recovery of disaster victims. Home loans, business loans, debris clearance, rental and food allowances, and other services are now available to the private citizen. This has brought a new dimension to disaster preparedness planning. A system is now required to deal with the long term recovery needs of individuals. Cities must be prepared to establish what we call "Service Centers" where disaster victims can register their needs and learn what help the government can give them.

Prior to this recent legislation, all personal inquiries of individuals were turned over to the Red Cross. With the Federal Government now performing a large portion of the role formerly handled by the Red Cross, a considerable adjustment in the Red Cross program has been necessary.

The conventional federal assistance to local government for the purpose of replacing essential public services and facilities damaged or lost in major disasters remains unchanged by the new legislation.

I will use my remaining few minutes philosophizing on the lessons of the past and how well we have learned these lessons. I will relate my remarks primarily to earthquakes, although they generally apply to all major catastrophes.

The first earthquake for which there are detailed descriptions occurred on November 1, 1755, in the vicinity of Lisbon, Portugal. An estimated 30,000 people were killed and shocks from the quake were felt in many parts of the world, including the American colonies, where "chandeliers rattled." After the quake, Portuguese priests documented their observations, and their records —still preserved—represent the first systematic attempt to investigate an earthquake and its effects. Since then, detailed records have been made of almost every major quake.

In spite of the excellent documentation that has been made concerning these greatest of geophysical events, we find very little long term impact in terms of being better prepared at the local level to overcome the immediate effects of a disaster. Several times I have heard it said, "How lucky we were that the February 9th earthquake in Los Angeles County occurred at 6:00 A.M. and not an hour later", or "How lucky we were that the epicenter was not 20 to 25 miles further south in the heart of the built up area." And I agree because with the extremely heavy traffic and with the many older structures that fail to meet the latest building standards, there is no question but what the several cities within the Los Angeles complex would have been completely overwhelmed even though this was only a 6.6 magnitude earthquake.

The awe, fear, and compassion evoked by a great movement of the earth and the devastation it wreaks are intense and long remembered by the individuals caught up in the catastrophe. And yet, despite the immediate effort inspired by the strong emotions and needs of the moment, very little long term improvements in the degree of local level preparation for these events seems to evolve. We can only say that the final public record reflects an inadequate result.

Whereas the Federal Government now provides a considerable amount of assistance, it remains for the city to withstand the first massive onslaught of the disaster. The city stands alone during those first frightful hours or perhaps days, and it is during this initial period of time when the good building codes, the good communications, the good decision making, and the good planning pays off in terms of lives and property saved. What is done or what is not done during this early period more than anything else will determine how well the public trust has been preserved.▲

U.S. RADIO WARNING SYSTEMS STATUS

by

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Studies of nuclear attack, as well as experience with natural disasters, provide convincing evidence that adequate warning is one of the key factors in saving lives in such situations. For over twenty years, the Federal Government has provided financial assistance to state and local governments for the installation of community sirens for warning purposes. However, the coverage of sirens is limited and their effectiveness at night is low.

For years, the Federal Government has studied a variety of ways of using broadcast communications systems—radio and television—to get warning information directly to the listener. In the early post war period, CONELRAD was instituted for this purpose. CONELRAD provided emergency information to the public on two frequencies, 640 and 1240 kilohertz. All other commercial broadcasting was suspended. Commercial stations were used to broadcast on these two frequencies, using a transmission pattern designed to prevent enemy bombers from homing in on radio transmissions.

The EBS System

By 1963, the radio had ceased to be a useful means of navigation for enemy attackers, so the CONELRAD system was replaced by the Emergency Broadcast System (EBS). The EBS permits selected stations to broadcast at normal power on their assigned frequencies during emergencies, to allow the President to address the nation and to provide supplementary emergency information from Federal, state, and local agencies. Civil defense warning announcements were incorporated in the procedures for activating the EBS, although sirens continued to be the primary civil defense warning system.

While commercial broadcast stations can quickly relay a warning to the listening audience, they cannot reach people whose radio or television sets are turned off. Hence, means have been sought for using radio techniques to sound an alarm in every home at any time of the day or night. Research on a means of transmitting a signal through power lines was begun in 1951, culminating in the development of the National Emergency Alarm Repeater (NEAR) system. This system had to be abandoned, however, due to increasing interference from new electrical devices in the frequency band which NEAR was using.

When NEAR was abandoned, efforts were focused on the development of a system of over-the-air transmission of a special warning signal which would turn on (technically, de-mute) a receiver in the home (or car, or boat) and transmit a specific warning message. Three different approaches were pursued independently by three Federal agencies.

Decision Information Distribution System

The Office of Civil Defense (OCD) developed the Decision Information Distribution System (DIDS), which used ten government-owned low frequency transmitters to provide nationwide coverage. DIDS planners envisoned the use of separate low-frequency receivers for institutions including Federal, state and local government agencies, and a low frequency receiver incorporated in a standard radio or television set for reaching the general public.

The National Oceanic and Atmospheric Administration (NOAA, formerly ESSA) augmented its nationwide weather teletype network with a network of VHF radio transmitters planned ultimately to cover coastal areas and the "tornado belt." Owners of VHF receivers can receive continuous weather information on the NOAA channel. A new receiver with a demuting feature has recently been developed which would permit NOAA to "turn on" the receiver with a special warning signal. Currently this receiver costs about $150.00 and very few have been sold.

At the request of the Federal Communications Commission, its National Industry Advisory Committee (NIAC) developed a signalling technique which would enable a commercial broadcast station to de-mute a specially designed radio receiver if it were tuned to that station. Incorporating this technique into the EBS could also provide a widespread warning capability.

A fourth approach to warning, using the telephone system, was also under consideration by OCD. By the end of 1970 it became clear that unless the public was to be faced with a bewildering array of different warning systems, some fundamental decisions would be necessary. A review was undertaken within the Federal Government, led by Clay T. Whitehead, Director of the President's Office of Telecommunications Policy in the Executive Office of the President, to determine what system or systems could best and most economically meet the need to warn the general public of the United States in an emergency.

The first step in the review was to establish the goals that a warning program should meet. While there are a variety of pertinent technical goals, the following factors most significantly affect the choice of systems.

Warning System Goals

First, the warning system must be capable of reacting in seconds. Studies have shown that timeliness is critical for civil defense warning. Delays of 5 to 10 minutes could greatly diminish the benefits of a nationwide public warning system. A response time of 30 seconds was established as the objective to be met by any warning system designed to meet civil defense needs.

Second, the warning system must be operative 24 hours a day. The critical deficiency in current warning systems is coverage during the night. The principal advantage of a radio warning system capable of reaching into the home is that it can wake people up.

Third, any 24-hour warning system designed to provide weather and natural disaster warnings must be highly selective. Such warnings are valid only for relatively small geographical areas. The widespread dissemination of a weather warning would unnecessarily disrupt the lives of many who would be totally unaffected by the particular threat. Unless such false warnings can be held to the absolute minimum, large segments of the public could become disenchanted with the warning system and would disable their receivers.

Finally, to assure public confidence, the system must be highly reliable. Unobtrusive means of testing should be available to assure the owner that his receiver continues to function. False activation of the receiver must be virtually eliminated.

It became obvious early in the review that only one system had, up until this time, been thoroughly planned and engineered to meet these requirements. That was DIDS. With the nationwide coverage provided by its ten government controlled transmitters, DIDS would be capable of alerting over 98% of the U.S. population within 30 seconds, at any time of the day or night. Use of its addressing feature would permit DIDS to selectively address any of 5,000 or more individual geographic areas. While there were some uncertainties with respect to DIDS, there were equal or greater uncertainties associated with all of the other candidate systems which were under consideration. The principal question addressed in the review was whether any other system could come close to meeting the objectives at a cost significantly lower than the expected costs of the DIDS system.

System Costs

A few simple calculations showed that the cost of any nationwide warning system receiving a high degree of acceptance would be dominated by receiver costs. At costs ranging from $5 to $25 per receiver, a system with one receiver in each of the 66 million American households would entail an expenditure within the range from a third of a billion to one and a half billion dollars for the receivers. The transmitter system costs of roughly $35 million for DIDS, or a lesser figure for the use of existing private broadcast facilities, are not a major factor in the selection of the most economical warning approach. It would be a disservice to the American public to minimize the transmitting cost of the warning system while ignoring the much higher costs of an effective distribution of receivers.

Unfortunately, the problem had not been looked at this way before, and sound comparative receiver costs studies were not available. Only very rough cost estimates were available. However, a qualitative comparison of the functions to be performed by the receiver in different systems allowed a determination of relative costs sufficient to accomplish the purpose of the review.

Certain alternatives were readily dismissed as being inferior to DIDS. A study of the feasibility of using the telephone system for warning had been completed by the telephone company for the Office of Civil Defense. That study revealed that the use of the telephone system to provide a comparable warning service would be at least as expensive as DIDS, and would provide coverage to only about 85% of the U.S. population. In addition, such use of the telephone system would disrupt normal communications at critical times. All things considered, the use of the telephone system did not appear to provide an attractive alternative to DIDS for national warning.

Next we considered the possible use of AM or FM radio broadcast stations, television broadcast stations, or expansion of NOAA's VHF warning system. Because of the large number of transmitters which would have to be linked and controlled for any of these approaches, it was clear that there would be no advantage to any of these systems unless some way could be found to make the warning receivers significantly cheaper than a DIDS receiver. Two possible ways to do this were analyzed: (1) by using the geographical selectivity inherent in FM, TV or VHF coverage patterns instead of using the digital address scheme included in DIDS, or (2) by use of a "tunable" receiver.

The Receiver

The DIDS system would achieve the necessary geographic selectivity by including in each receiver an address decoder capable of distinguishing 5,000 or more different digital addresses. The inclusion of this address decoder adds to the cost of the DIDS receiver, as does the need to provide a means for changing addresses whenever a household moves from one addressing area to another. Since FM, TV and VHF signals are limited to a radius of 25 to 40 miles, a degree of selectivity could be provided which might serve as an alternative to the digital addressing scheme. However, there would only be about 500 different addressable areas in such a scheme. On the average, the minimum area warned in this case would be at least ten times larger than the minimum area addressable in DIDS. This represents a considerable loss in selectivity.

The DIDS receiver is a fixed-tuned receiver. Whether packaged separately or included in another piece of home entertainment equipment, it would require its own antenna, front end, and demodulator, in addition to the

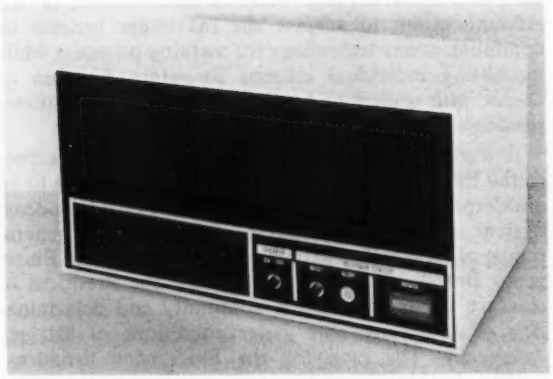

Figure 2. The DIDS receivers will automatically deliver an alerting voice or teletype message to selected key locations or can sound a warning by sirens on command sent by unattended transmitters.

address decoding and filter circuits. If AM or FM broadcast stations were used, an alternative would be to use the normal "tunable" receiver front end, simply introducing the filter and control circuitry necessary to identify and decode a warning signal. An AM or FM radio designed for use as a warning receiver in this manner would, when not in use, be in a powered but muted condition. If the correct warning alert signal were transmitted by the radio station to which the receiver was tuned, it would activate the filter circuitry and demute the set. The elimination of the fixed-tuned front end would reduce the cost of adding this type of warning feature to a conventional radio set. However, this approach has operational disadvantages.

The tunable receiver would provide a warning only if it is tuned to a station which is on the air when the warning is to be sounded. Since many popular stations go off the air some time during the evening, radio or television sets left tuned to these stations would not be activated in the middle of the night by a warning signal unless those stations were left in a standby condition at all times and could be remotely activated by the Federal Government. This could be overcome if the homeowner were willing to retune his radio to a 24-hour station before turning it off at night. This is expecting too much of human nature.

Careful consideration of these factors led to the conclusion that those alternatives to DIDS which had the potential for significant savings in receiver costs also entailed losses of selectivity or reliability which could seriously compromise the effectiveness of the warning system.

Receiver Distribution

Another factor affecting the usefulness of a national warning system is the means by which receivers would be distributed to the population at large. Unless the warning receiver is accepted into the home, the system will not be effective at night, and will probably achieve little more in the way of warning coverage than the existing siren systems.

Studies made several years ago indicated that a warning receiver sold separately would not achieve a very significant market penetration. This led to consideration of the possibility of incorporating the warning receiver into an item of home entertainment equipment. This would achieve certain savings in manufacturing costs due to the sharing of such common items as power supply and speaker. Distribution costs would also probably be reduced relative to the cost of distributing a stand-alone item. Television sets are the obvious choice as a "carrier" for the DIDS receiver, because of the very high penetration of television sets into the home market, and because the percentage impact of the DIDS receiver on the overall cost of the television set would be small. Legislation requiring the incorporation of a warning receiver in every new television set would, within ten years, achieve a very high penetration of warning receivers, and would assure that the economies of mass production would be fully exploited in the manufacture and distribution of warning receivers.

There are, however, overriding disadvantages to such legislation. Part of the problem is psychological. The thought of the government's voice booming out from a television set conjures up images of Orwell's famed novel *1984*. Commentators have already raised this specter, although the analogy is very poor. "Big Brother" appeared in sound and picture, preempted all other programming, and was capable of listening in on individual households. The DIDS system would provide only voice transmission of warning messages, is clearly limited to one-way transmissions to the home, and does not preempt other programming. If included in a television set as described, the DIDS receiver would be disabled whenever the television set is on. Hence the listening television audience would receive the warning through the cooperation of the private broadcast industry.

There is no precedent for the government requiring every citizen to purchase a device solely for the purpose of allowing the government to communicate with the citizen. However valid this approach may be in consideration of the warning mission, it will surely be objectionable to many on general policy grounds. American society today is faced with considerable uncertainty about where the rapid evolution of communications and information handling technology is taking us. The Office of Telecommunications Policy, in coordination with other elements of the government and with the private sector, was established to clarify these issues and to provide improved mechanisms by which the nation can direct the use of these technologies into socially desirable channels. Until a clearer national understanding and consensus about the role of these technologies emerges, however, legislation of the kind we have been talking about is bound to be misunder-

stood. Accordingly, a conscious decision has been made by this Administration that any warning receiver entering the home should be purchased voluntarily by the individual citizen.

It is recognized that this decision means at least initially, that the warning system will not achieve a very high overall penetration because of the decisions of individual home owners about their participation in the system. A change in the national climate or the clear appearance of an external threat could, of course, radically change this initial situation. For the present, however, the responsibility of the government is basically two-fold. First, to provide warning signals which can be received by any citizen who is willing to buy the warning receiver. Second, to design the system so that the home warning receiver can be as inexpensive as possible. The price of such a receiver should be so low that every household can afford one. Economic discrimination in the distribution of warning receivers would undoubtedly be recognized as grossly unfair.

Government Actions

In accordance with these conclusions, the government of the United States, is proceeding with several related actions. The first operational DIDS warning transmitter is being constructed in Maryland and will be completed in mid-1972. This transmitter will provide for a thorough operational test of the DIDS system with its selective addressing capability. In addition, the Office of Civil Defense is undertaking design studies for home receivers in order to fully validate the design concept and to provide a firmer basis for determining the ultimate cost of these receivers. Cost performance tradeoffs are being reviewed once again to assure that every feature which adds to the cost of a home receiver is truly desirable in the context of a voluntary home warning program. These actions reflect the commitment of this Administration to achieve the maximum benefits of communications technology for warning purposes while permitting individual citizens to retain freedom of choice with respect to both economic and operational participation in the system.

A word of clarification may be in order with respect to the Emergency Broadcast System. There seems to be a widespread public belief that the Emergency Broadcast System is the primary means of warning the general public of an attack. Actually, the purpose of the Emergency Broadcast System is to permit the President to reassure the Nation of the continuity and determination of its government under conditions of extreme emergency. The plan for the Emergency Broadcast System permits Federal agencies, including the Office of Civil Defense, to use the system to pass other emergency information once activated by the President. The Office of Civil Defense had therefore planned to use the system on this basis to pass emergency information and instructions.

As a result of a recent review of the Emergency Broadcast System, the White House, the Federal Communications Commission, and the Office of Civil Defense have agreed to remove the warning function from the Emergency Broadcast System. The Office of Civil Defense will make separate arrangements for the transmission to news media of information concerning any attack upon the United States. The Emergency Broadcast System will be designed to perform optimally its function of allowing the President to address the American people at times when it is appropriate for him to do so. The Office of Telecommunications Policy, in conjunction with the FCC and with the government and private organizations involved in the EBS, will continue to seek improvements to the EBS which will maximize its effectiveness in serving that purpose. ▲

The Joint United States-Canada Civil Emergency Planning Committee met in Ottawa in June, 1972, to review emergency planning developments between the two countries during the past year.

This year's annual meeting dealt with matters of cross-border mutual interest in civil emergency planning for war and the emphases being placed on preparations to cope with major peacetime emergencies.

The joint committee of senior officials of the Canada Emergency Measures Organization, the U.S. Defense Civil Preparedness Agency (formerly Office of Civil Defense) and the U.S. Office of Emergency Planning was established by the federal governments of both countries in 1963. The Department of External Affffairs and the U.S. Department of State are also represented. It meets in Ottawa or Washington each year to exchange ideas, ensure compatibility of emergency measures, and develop recommendations for consideration by each government.

This year the committee dealt with emergency plans and reports in the economic areas of fisheries, food, fuel and energy, industry, manpower, communications and transportation; province-state arrangements; and civil defence liaison in times of tension.

The senior delegates at the 1972 committee meeting were, left to right: Governor John E. Davis, Director, Defense Civil Preparedness Agency; General G. A. Lincoln, Director, Office of Emergency Planning; and Chairman C. R. Patterson, National Coordinator, Civil Emergency Measures, Canada Emergency Measures Organization.

CHINA'S EVOLVING NUCLEAR DETERRENT

by

Charles H. Murphy

How far has China progressed in building-up a credible nuclear deterrent? Charles H. Murphy, a China specialist and defence analyst with the US Library of Congress, claims that China could acquire a limited but credible second-strike capability in five to seven years. The following contains extracts from the article.

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The construction of a large ballistic missile launch facility at Shuang-ch'eng-tzu, which began in 1965, led the American intelligence community in late 1966 to the conclusion that the Chinese were pursuing an ICBM (intercontinental ballistic missile) programme with a high priority. On the basis of available evidence, it was estimated that they could conduct an ICBM flight test or space launch before the end of 1967. However, for unknown reasons, the Chinese dismantled the ICBM test stand in 1968-69 and did not finish rebuilding it until February 1970, at which time the US Defense Department again announced that the Chinese were ready to test launch an ICBM or space booster. Two months later, the Chinese placed a relatively heavy first satellite in earth orbit, using a two- or three-stage liquid-fuelled launch vehicle, the first stage of which was the IRBM currently under development.

The potential ICBM applications of the space launch vehicle have been subsequently under-scored by US Defense officials. In May 1970, shortly after the first shot, a Pentagon spokesman said 'the satellite launching confirms their technological progress; prudence requires that we continue to credit them with a near term capability to fire their first ICBM'. When the Director of Defense Research and Engineering, John S. Foster, was asked during an interview in November 1970 about the possibility of a Chinese ICBM test, he replied that 'it could come at any time'. But more important, he went on to say that they had 'put a satellite into space with a capable rocket system,' and 'continued development of such a system could give them an ICBM capability'. In March 1971 Secretary of Defense Laird indicated that China's progress towards achieving an ICBM capability is continuing. At the same time, he pointed out that the successful launching of a satellite in April 1970 demonstrated adequate sophistication for the progressive development of ICBM systems. Japanese intelligence has reported that China's first spaceshot served as a test for completing its inter-continental ballistic missile system.

The launching of a second heavier satellite from the Shuang-ch'eng-tzu space facility in March 1971 was interpreted by US Defense analysts as further confirmation of China's near term capability to test fire an ICBM. The Defense Department subsequently intimated that the satellite booster might have ICBM applications. Admiral Thomas H. Moorer, Chairman of the Joint Chiefs of Staff, told the Senate Armed Services Committee on 15 March 1971 that the "the successful orbiting of these satellites represents a significant advance in Chinese missile propulsion and control systems, and a major step forward towards an ICBM'. This assessment was reiterated more recently by Foster in testimony before the House Armed Services Committee on 22 April 1971.

The US Defense Department estimates that China could attain an initial operational capability with ICBMs within three years after flight testing commences. Although the start of testing has not yet been confirmed, Secretary of Defense Laird suggested in a March 1971 statement that reduced range testing of an ICBM within China's boundaries may have started in late 1970. William Beecher of the *New York Times*, who seems to have access to very reliable sources, claims that these tests involve the firing of the three-stage satellite launch vehicle in a missile configuration from the new experimental launch site in north-east Manchuria into western Sinkiang, covering a distance of 2,200 miles. This information seems to suggest that China will use its IRBM, or the first-stage of the satellite launch vehicle, as the booster or first stage of the ICBM. However, while this three-stage missile might be capable of delivering a small payload 6,000 miles, it lacks sufficient power to deliver the 3-megaton warhead the Chinese are developing for their ICBM over such distance. ICBM range and payload capacity will probably be achieved by adding another upper stage to the multi-stage booster vehicle used in both space shots.

If an initial capability is achieved by mid-1973, which the Pentagon considers possible but unlikely, a force of 10 to 25 first-generation liquid-fuelled ICBMs, each with a 3-megaton thermonuclear warhead and a 6,000-mile range, could be on launchers by mid-1975. However, it is more likely that their ICBM will not attain an initial operational capability until 1974 or 1975, in which case they would not have a significant number of ICBMs, deployed until late in the decade, possibly by 1978.

A solid propellant production plant has been built, and their is evidence suggesting that a second-generation ICBM, with this type of power plant, is being developed for silo emplacement, although it is not expected to be ready before 1975 at the earliest.

Testing Problems

Up until very recently, one of the main obstacles to the start of China's ICBM flight test programme was the lack of adequate test range and associated land- and sea-based tracking and test range instrumentation systems. Apparently, both problems have been resolved. China's ICBMs will reportedly be launched from Shuang-ch'eng-tzu out over a 6,000-mile range, carrying the missile across India for a splash-down in the Indian Ocean near the East African Island of Zanzibar, where Chinese technicians are installing what is thought to be elaborate telemetry equipment that will monitor the final phase of flight to determine missile accuracy.[1] This facility will also play an important role in China's burgeoning space programme. Additional range monitoring capabilities will be provided by expansion of existing missile-range tracking stations in Sinkiang, by the 12,000-ton Chinese space and missile tracking ship *Hsian Yang Hung*, which has already been into the Indian Ocean on a shakedown cruise,[2] and possibly by other tracking facilities to be built in Ceylon, Pakistan and Tibet or in a second East African country. Recovery of the dummy warhead will probably be undertaken by a Zanzibar-based Chinese missile-recovery ship.

The US intelligence community believes that theTu-16 *Badger* twin-engine medium-range jet bomber, which is now in series production, will be China's principal aircraft for nuclear weapons delivery and probably its primary nuclear delivery system in the near future.

While the Russians supplied the Chinese with a few Tu-16s in the late 1950s and helped them set up the aircraft factory near Sian (Shensi Province) where they are being produced, the first Chinese version of the Tu-16 did not come off the production line until 1968-69. US weapons specialists estimate that this plant has the capacity to produce up to five of these bombers a month.[3] However, the Chinese are thought to be producing only two or three a month, or up to 36 a year, meaning they might have from 72 to 108 Tu-16s currently in inventory. In February 1970, Mr. Laird reportedly told a Senate Committee that the Chinese might have more than 60 Tu-16s. More recently, in his annual report to Congress on 9 March 1971, Mr. Laird predicted that the Chinese would have a significant force of Tu-16s by mid-1972. If these estimates are correct, China might have as many as four Tu-16 air regiments or roughly 130 of these aircraft by that time.

That Chinese military planners would decide to develop, produce and deploy strategic bombers and missiles simultaneously indicates that they have opted for a mixed nuclear force as did the United States and the Soviet Union. The possession of several hundred Tu-16s, which are comparable to the phased-out US strategic B-47 bomber, will enhance considerably the credibility of China's regional nuclear deterrent, especially over the short-run. First, the availability of numerous airfields throughout China from which this bomber can operate will reduce its vulnerability to pre-emptive attack. Second, inasmuch as each Tu-16 will be equipped to carry one or two 3-megaton fusion weapons or several lower-yield fission weapons and each will have an operational radius of approximately 2,000 miles and a maximum speed of 600 miles per hour, the Chinese would be in a position to threaten the destruction of several major Soviet cities, Soviet troop concentrations along the Sino-Soviet border and American military bases in Asia during a confrontation. The effectiveness of China's Tu-16 could be improved significantly by the development of air-to-surface missiles and an in-flight refuelling capability, which would extend its mission radius out to around 2,700 miles.

Submarine Construction

While the Chinese apparently intend to deploy several different strategic weapons delivery systems, a submarine-launched missile will not be part of their nuclear deterrent, at least not in this decade. US weapons experts now estimate that it would take Chinna 8 to 10 years to develop and deploy a nuclear powered missile-launching submarine comparable to the US *Polaris* system.

During the late 1950s and early 1960s the Chinese commissioned 22 long-range diesel-powered submarines all of which had a potential missile-launching capability. Their submarine fleet has continued to grow, and today the Navy's main offensive strength centres on a growing force of more than 40 diesel-powered attack submarines. However, the emphasis in submarine construction is currently on medium-range attack rather than on strategic missile-launching boats, In fact, China's only strategic missile-firing submarine (Soviet G-Class) was was built in the Dairen (Liaoning Province) shipyards more than six years ago, and related naval missile systems have never been developed. More recently, the Chinese have been building an improved version of the Soviet R-Class diesel-powered medium-range attack submarine, and on 7 June 1971, the US Defence

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[1]Chin Ch'ien-li, 'Survey of Chinese Communist Artillery and Second Artillery', *Hsing-tao Jih-pao* (Hong Kong: 29-31 Dec. 1970), p. 5; 'Communist China: New Base', *Military Review*, March 1971, p. 106; *Aviation Week and Space Technology*, 24 Aug. 1970, p. 11; S. K. Ghosh, 'The Tanzam Railway', *Institute for Defence Studies and Analyses Journal*, Oct. 1970, pp. 198-9; F. S. Hoffman, 'Chinese Trying to Get Ceylon Port Facilities', *Washington Star*, 20 March 1971; P. Keatley, 'China to Fire Missile Across Indian Ocean,' *The Guardian*, 25 Setp., 1970; R. W. Howe, 'Powers Active in Indian Ocean', *Baltimore Sun*, 16 April 1971.

[2]Hoffman, *op. cit*; William Beecher, 'China's ICBM Test Said to be Closer', *New York Times*, 31 May 1971.

[3]M. Getler, 'Red China Makes Own Jet Bomber', *Washington Post*, 18 Sept. 1970; 'The Dragon Comes of Age', *New Scientist*, 1 Oct. 1970.

1. DATA ON FIRST SUCCESSFUL SATELLITE LAUNCHINGS EXECUTED WITH INDIGENOUS LAUNCH VEHICLES

Country	Date	Spacecraft Designation	Payload Weight (lb.)	Estimated Gross Weight (lb.)[a]	Launch Vehicle
Soviet Union	4 Oct. 1957	*Sputnik I*	184[b]	13,000	2-stage modified SS-6
United States	31 Jan. 1958	*Explorer I*	31	31	4-stage *Jupiter C*
France	26 Nov. 1965	*A-1*	92	150	3-stage *Diamant-B*
Japan	11 Feb. 1970	*Ohsumi*	51[b]	100	4-stage *Lambda* 4S-5
China	24 April 1970	*Chicom I*	381[b]	1,200	multi-stage modified IRBM

a Includes weight of accompanying rocket casing.
b *Sputnik II*, which was launched on 3 Nov. 1957, weighted 1,120 lbs.; Japan's second satellite, *Tansei*, which was launched on 16 Feb. 1971, weighed 139 lbs.; China's second satellite launched on 3 March 1971, weighed 486 lbs.

Department reported that China was constructing its first nuclear-powered attack submarine.[4]

The complete cessation of strategic submarine construction in 1964 and the ensuing move towards a more defensive maritime posture seem to indicate that the Chinese have either assigned the submarine-launched missile programme a much lower priority, or abandoned it altogether in favour of an accelerated plan for the development of a land-based nuclear deterrent system. China's diesel-powered submarines, with their limited endurance and high noise levels, would have been extremely vulnerable to American and Soviet anti-submarine counter-measures, and the cost of developing more effective submarine-launched missile systems quickly might have been prohibitive. For example, the procurement costs for the 41 US *Polaris*-launching nuclear submarines each with 16 missiles have ranges up to 2,900 miles, has been estimated to be $13 billion. By comparison, the Chinese could deploy 50 ICBMs in hard emplacements, 100 IRBMs in soft sites, and 300 medium-range jet bombers equipped with air-to-surface missiles for only about $4.7 billion.

Space Programme

When China put up its first satellite weighing 3.1 pounds from the Shuang-ch'eng-tzu space launch facility on 24 April 1970, it became the fifth nation to successfully orbit a satellite with an indigenous launch vehicle. It was the heaviest first satellite launched to date. In fact, it was heavier than the combined weights of the first satellite payloads orbited by the Soviet Union, the United States, France and Japan, as Table I indicates.

Furthermore China developed the technology faster than any of the others. While it took China only 5.5 years to progress from its first nuclear test explosion to its first satellite launching, it took the United States 12.5 years and the Soviet Union 8 years to make this same transition. And the Japanese, who have been developing rockets for some 20 years, only beat the Chinese by two months and, then, only after four unsuccessful attempts, beginning in September 1966.

The orbiting of two satellites during the past year and a half seems to presage a major Chinese entry into space for political, military and scientific purposes. In testimony before a House Defense Appropriations Subcommittee taken the day after the first Chinese satellite launching, John S. Foster, Jr., Director of Defense Research and Engineering, stated that the spaceshot was 'not simply an attempt to make a show by launching a single object into space'. Instead, he thought, 'it is the beginning, much more likely, of a continuing rather large, intense space programme'. But in Foster's opinion, the launch was not associated with any kind of milttary weapon in space. The Chinese government made a first cryptic reference to its future space plans in an official press communiqué released on 25 April 1970, the day after the first satellite was orbited, stating that the launching marked 'a good beginning in the development of China's space technology'.

During further questioning before the same House sub-committee, Foster also disclosed that the Chinese 'clearly have the basis for a very large space boost capability' that will be necessary to sustain such a programme. Shortly after the first satellite was launched, the space tracking devices of the North American Air Defense Command detected a second Chinese object orbiting the earth about 2,000 miles ahead of the active satellite, which was thought to be part of the final stage of the launch vehicle. The US Defense Department subsequently stated that it would have taken a very large booster to have placed the weight of the two objects, estimated to be no more thans1,200 pounds into orbit.[5] Although the Soviet SS-4 *Sandal*, which is probably very similar to the Chinese MRBM, has an orbital lift capacity of only 600 pounds (plus carrier rocket) when a second stage is added to improve performance, the Soviet SS-5 *Skean*, which is probably

[4] M. Getler, 'China Builds Nuclear Sub, Photos Hint', *Washington Post*, 5 June 1971.

[5] C. S. Sheldon, Interview, Library of Congress, Washington, D.C., April 1971.

2. DATES OF FIRST NUCLEAR AND THERMONUCLEAR TEST EXPLOSIONS

Country	First Atomic Test	First Full-Scale Thermonuclear Test	Transition Time (years)
United States	16 July 1945	1 Nov. 1952	7.5
Soviet Union	29 Aug. 1949	12 Aug. 1953	4
Britian	3 Oct. 1952	15 May 1957	4.5
France	13 Feb. 1960	24 Aug. 1968	8.5
China	16 Oct. 1964	17 June 1967	2.5

3. CHINA'S NUCLEAR WEAPONS TESTS

Date	Yield	Delivery System	Location
16 Oct. 1964	20 KT	NA (Tower-Mounted)	Lop Nor
14 May 1965	20-40 KT	TU-4 (medium prop. bomber)	Lop Nor
9 May 1966	200-500 KT[a]	TU-16 (medium jet bomber)	Lop Nor
27 Oct. 1966	10-20 KT	MRBM (Soviet-type SS-4 *Sandal*)	Shuang-ch'eng-tzu/ Lop Nor
28 Dec. 1966	250-500 KT[a]	NA (Tower-Mounted)	Lop Nor
17 June 1967	3 MT[b]	TU-16	Lop Nor
24 Dec. 1967	10-25 KT[a, c, d]	TU-16	Lop Nor
27 Dec. 1968	3 MT[b, e]	TU-16	Lop Nor
23 Sept. 1969	25 KT	NA (Underground)	Lop Nor
29 Sept. 1969	3 MT[b]	TU-16	Lop Nor
14 Oct. 1970	3 MT[b, c]	TU-16	Lop Nor
18 Nov. 1971	20 KT	NA (Tower-Mounted)	Lop Nor

a Experimental device containing thermonuclear material (lithium-6).
b Thermonuclear warhead.
c Unannounced by the Chinese government.
d Probable failure (only the fission cycle was completed).
e Contained plutonium.

comparable to China's IRBM, has been used as the basic first stage, with upper stages added, to orbit payloads up to 2,000 pounds (plus carrier rocket). Some defence analysts have estimated that the Chinese are developing a 1.5-million pound thrust booster comparable to those used by the Russians in their early ICBM and space programmes[6]. For instance, on 12 April 1961, the Soviet Union launched *Vostok I*, the first manned orbital spacecraft, weighing 10,419 pounds, with a 3-stage modified SS-6 *Sapwood* booster assembly produced about 1.3 million pounds of thrust. New and additional stages were later added to the SS-6 booster, improving its gross payload-carrying ability to about 16,500 pounds in earth orbit or 3,600 pounds in lunar orbit. (It is also interesting to note that the first US manned orbital spacecraft, which was launched 20 February 1962, weighed only 3,000 pounds.) With such a space boost capability, the Chinese could also undertake manned orbital spaceflights.

While the Chinese will certainly exploit their space feats for propaganda purposes, the primary objective of their space programme, according to defence experts, will be the deployment of satellite-borne intelligence and communications systems. Given the overwhelming nuclear superiority and near first-strike capabilities of the super-powers *vis-a-vis* mainland China, the military authorities in Peking will have to be able in the event of a counter-force first strike, to launch their strategic missiles and bombers before or immediately after the first incoming warheads begin detonating. To achieve such a capability, the Chinese will have to develop and deploy satellites that can gather electronic, communications and photographic intelligence as well as those that can provide an early warning against missile attack. Photographic reconnaissance satellites would be particularly useful at the present time for monitoring Soviet troop movements and military construction along the Sino-Soviet border. Since the weight of the radio transmitter and telemetry systems on board China's first satellite is probably less than one-third of the total weight—even allowing for triplication—there has been speculation that the remaining space contained equipment under test for a satellite reconnaissance system.[7] However, this is considered most unlikely in view of the limited quantity of telemetry transmitted by the satellite.[8] The Chinese are probably also anxious

[6]M. Getler, 'Chinese Space Program Held Intense', *Washington Post*, 28 July 1970.

[7]F. Barnaby, 'SALT With the Eastern Star', *New Scientist*, 7 May 1970, p. 292; 'China's First Satellite', *Flight International*, 30 April 1970, p. 710.

[8]Sheldon, *op. cit.*; *Flight International*, *op. cit.*; G. E. Perry, 'Telemetry from the First Chinese Artificial Earth Satellite', *Nature*, 30 May 1970, p. 829.

to develop communications satellites to improve command and control over the conventional and evolving nuclear forces, which are dispersed across China's vast land area.

These developments, when coupled with the construction of a large ballistic missile production facility, suggest that the Chinese intend to compete on a large scale with the United States and the Soviet Union in the field of strategic nuclear weaponry. Although it would be impossible for them to gain parity with the superpowers—at least in this decade—they could acquire a limited but credible second-strike capability in five to seven years.

Overwhelming American nuclear superiority will continue to deter offensive nuclear threats or action by China. Alice Langley Hsieh, in testimony before a US Senate Foreign Relations Sub-committee in April of 1970, summed up her arguments in these words:, so long as the United States remains prepared to make the risk of overt Chinese military operations extremely high, the Chinese are likely to avoid military iniatives that might invite massive US nuclear retaliatory strikes'. American nuclear-weapons specialists have estimated that 10 per cent (60 aircraft) of the US's 1967 Strategic Air Command bomber force could kill 200 million Chinese, and that a few hundred B-52s loaded with high-yield surface-burst weapons could destroy China's urban and rural population—damage that should be more than sufficient for deterrence. An unprovoked Chinese first strike on American cities would clearly be suicidal. A nuclear first strike must always be launched against the opponent's strategic offensive nuclear forces, and must be just about 100 per cent effective. China's force will be of necessity a city-destroying retaliatory force, as it will initially be far too small and will lack the accuracy to be employed in a disarming first strike against American strategic offensive forces. Thus, first-use of nuclear weapons will not be a realistic alternative for Chinese decision-makers for many years to come.

Continued American deterrence of China, however, will not necessarily preclude Chinese deterrence of the United States in some situations. The mere existence of even a limited number of Chinese ICBMs, each having the capability ot destroy a large American city, would give serious pause to the United States during any confrontation with China. In the unlikely event of a US pre-emptive nuclear attack, the Chinese would almost certainly attempt to launch their ICBMs before they could be destroyed on the ground.[9] However, with the deployment of the new US '647' Integrated Early Warning Satellite System, which will provide instantaneous round-the-clock surveillance of Chinese launch sites, and the US *Minuteman-III* MIRV equipped missiles, which have the capability to destroy land-based missiles even in hardened silos, only a very small portion of the first-generated Chinese ICBM force would be expected to survive, as it will consist of long-reaction time liquid-fuelled rockets emplaced in inadequately hardened sites. Yet some Chinese missiles could survive, and it is this possibility that will almost certainly compel the United States to limit its military responses, especially any consideration of the use of nuclear weapons. Since 35 per cent of the population and 33 per cent of the industrial capacity of the United States are concentrated in the 10 largest cities, a few surviving Chinese missiles, in the absence of an American area-defence ABM system, would be capable of inflicting very serious damage on the United States, more damage than the Americans would wish to risk.

Although it is impossible to determine precisely what level of fatalities and damage is 'unacceptable,' i.e., necessary for deterence, the previous Administration talked about 20 to 25 per cent of population and 50 per cent of industry in the case of the Soviet Union. Henry A. Kissinger, Assistant to the President for National Security Affairs, has indicated that the US level of 'acceptable' damage is lower than this.[10] McGeorge Bundy, a former Special Assistant to the President for National Security Affairs, has intimated that the loss of just one American city would be 'unacceptable' in the eyes of 'real political leaders'. In an article appearing in *Foreign Affairs*[11] he said that 'a decision that would bring even one hydrogen bomb on one city of one's own country would be recognized in advance as a catastrophic blunder; 10 bombs on 10 cities would be a disaster beyond history; and 100 bombs on 100 cities are unthinkable'.

The Chinese have been testing a 3-megaton thermonuclear warhead which is thought to be suitable for ICBM use. One such weapon exploded on a large city could inflict well over a million casualties, and a salvo of between 10 to 75 such weapons, even if only 40 per cent reliable, could produce fatalities in the range of 7 to 23 million. Thus, while China's second-strike capability will be much smaller than that of the United States, it will be just as effective in deterring attacks. In the words of Secretary of Defense Laird, the Chinese 'can do proportionately as much damage to us with a relatively few missiles as we can do to them with a relatively large number of missiles'. In short, a Sino-American deterrent relationship will come into being as soon as China begins deploying operational ICBMs.▲

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[9]Laird, *Testimony Before Subcommittees of the Committee on Appropriations on Safeguard Antiballistic Missile Systems*, 22 May 1969, p. 60; Laird, *Statement Before a Joint Session of the Senate Armed Services Subcommittee on Department of Defense Appropriations*, 20 Feb. 1970, p. 43.

[10]H. A. Kissinger, *The Necessity for Choice: Prospects of American Foreign Policy* (New York: Harper, 1960), p. 17.

[11]McGeorge Bundy, 'To Cap the Volcano', *Foreign Affairs*, October 1969, p. 10.

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